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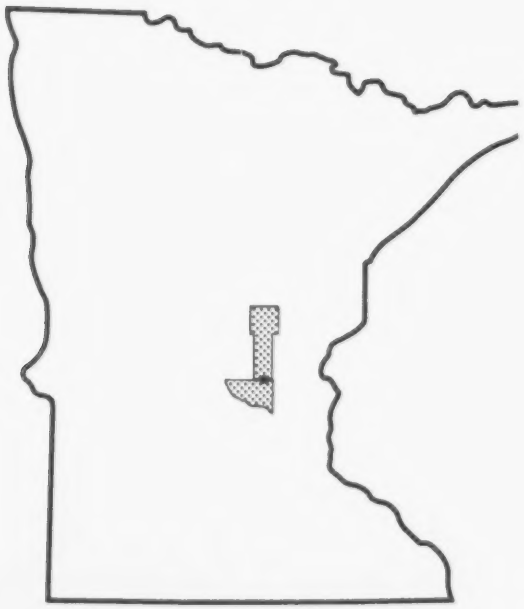
FLOOD INSURANCE STUDY

CITY OF PRINCETON, MINNESOTA

MILLE LACS AND SHERBURNE COUNTIES



DECEMBER 15, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 270292

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

CITY OF PRINCETON,
MILLE LACS AND SHERBURNE COUNTIES, MINNESOTA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Princeton, Mille Lacs and Sherburne Counties, Minnesota, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Princeton to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Geological Survey, Water Resources Division, Minnesota District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 19, Amendment No. 1. This study was completed in October 1979.

1.3 Coordination

The flood problems of the City of Princeton were reviewed at a meeting held December 7, 1976, with Princeton officials, and representatives of the FIA, the Minnesota Department of Natural Resources (DNR), the State Coordinating Agency, and the U.S. Geological Survey (USGS).

The discharge estimate for the 100-year flood for the Rum River and the West Branch Rum River were coordinated with the U.S. Army Corps of

Engineers (COE) and the Soil Conservation Service (SCS) to eliminate the possibility of future conflicts.

The City of Princeton, the COE, and the DNR were contacted during the study to obtain information.

A meeting was held with appropriate city officials on January 4, 1979 to inform them of progress on the study and to answer questions. Maps showing the delineation of the 100-year flood were provided to the city for the purpose of selecting a floodway configuration. Liaison was also maintained with the DNR, who will be reviewing the community's land-use controls for flood prone areas under the requirements of the State Flood Plain Management Act.

On July 29, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by local officials, representatives from the USGS, and representatives from the FIA.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Princeton, Mille Lacs and Sherburne Counties, Minnesota. The area of study is shown on the Vicinity Map (Figure 1).

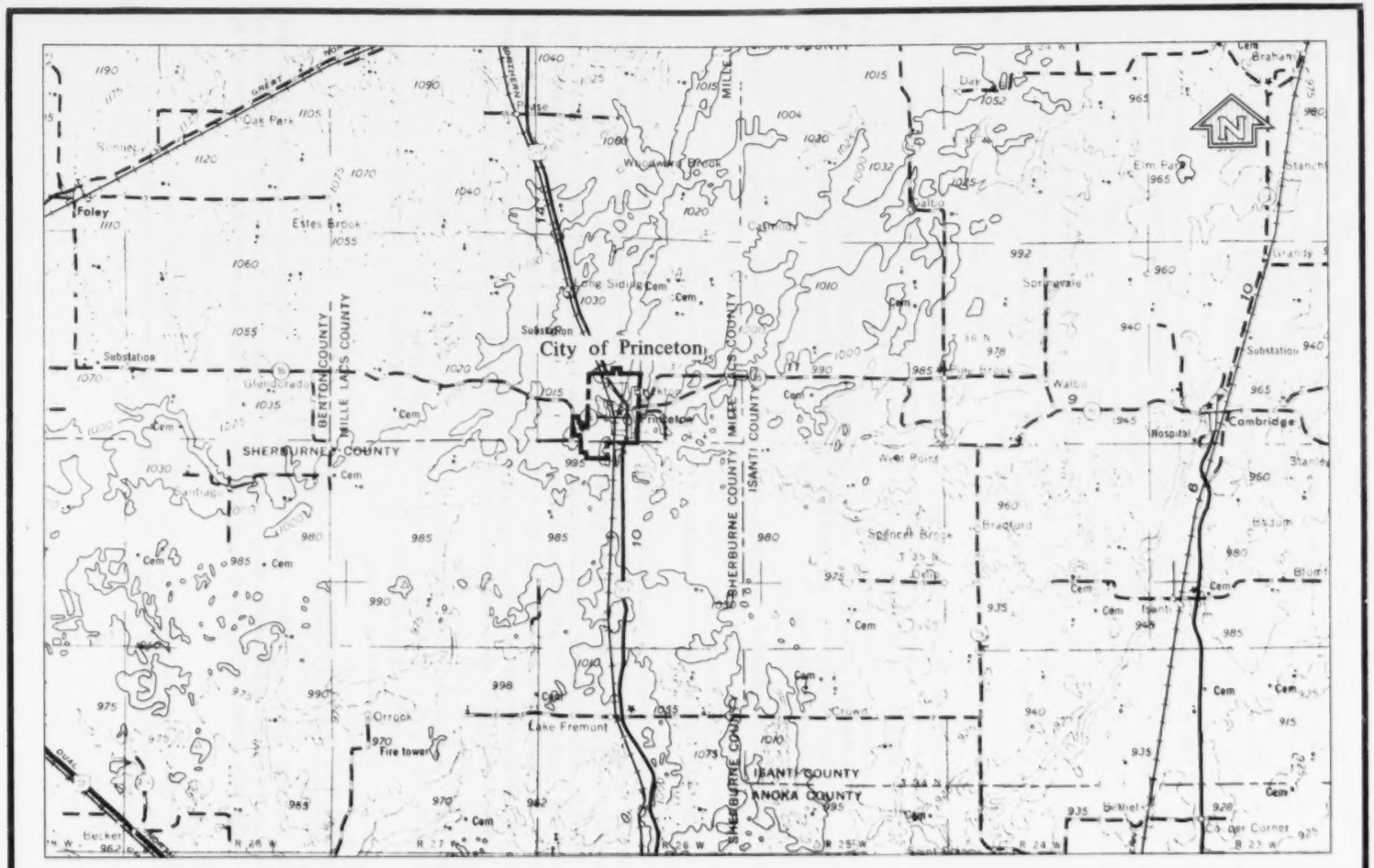
The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction through October 1984.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and the City of Princeton.

Areas subject to flooding by the Rum River and West Branch Rum River within the corporate limits were studied in detail.

2.2 Community Description

The City of Princeton is located in southern Mille Lacs County and northern Sherburne County, in east-central Minnesota. Princeton is about 50 miles north-northwest of the Twin Cities metropolitan area. It is bordered by the unincorporated areas of Sherburne County on the south and the unincorporated areas of Mille Lacs County on the other three sides. The area of the city is about three square miles. The population of Princeton according to the 1970 census was 2,531 (Reference 1). The U.S. Census Bureau estimated the 1976 population at 2,710.


City of Princeton
Princeton
Substation
Substation
Substation
Foley
Oak Park
Estes Brook
Wigwam Brook
Elm Park
Springvale
West Point
Spencer Brook
Cambridge
Hospital
Lake Fremont
Orrock
Fire tower
Becker
BENTON COUNTY
MILLE LACS COUNTY
SHERBURNE COUNTY
ISANTI COUNTY
ANOKA COUNTY
SHERBURNE COUNTY
ISANTI COUNTY
10
10
169
169
Cem
Cem
Cem

The climate of Princeton includes average daily summer temperatures which range from 81 degrees Fahrenheit (F.) to 57 degrees F. and average daily winter temperatures which range from 24 degrees F. to 5 degrees F. The average annual precipitation is 29 inches (Reference 2). Princeton's economy is based primarily on agriculture, but light industry is also located in the city.

The Rum River flows in a southerly direction making many meandering loops along the east side of the city. The West Branch Rum River enters from the northwest and joins the main stem northeast of the Princeton business district in the city park. Mille Lacs Lake, located about 38 miles north of Princeton, is the headwaters of the Rum River. Between Mille Lacs Lake and Princeton, the Rum River flows through agricultural land and woodland of mixed hardwood and conifers, and through the City of Milaca. The Rum River has many tributaries, some of which drain large swamps. The drainage area of the Rum River above the State Highway 95 bridge in Princeton is 784 square miles.

Most of the developed area of Princeton lies 20 or more feet above the normal water level in the Rum River and is not subject to flooding. The topography at Princeton is flat and the streams have cut wide flat valleys about 15 feet below the surrounding land surface. Terraces of stratified sand and gravel occur within the valleys of the Rum River and West Branch Rum River. The predominant soil type in the Princeton area is fine sandy loam (Reference 3).

Areas subject to flooding include the city park, undeveloped lowlands adjacent to the stream, and the Rum River Golf Course.

2.3 Principal Flood Problems

The areas immediately adjacent to the Rum River and the West Branch Rum River are subject to frequent flooding. Flooding usually occurs in the spring when snowmelt combines with spring rain. Heavy spring and summer thunderstorms have also caused flooding, as in July 1972 when a peak stage of 964.99 feet was recorded on the upstream side of State Highway 95 bridge, upstream from the confluence with the West Branch. The discharge for that flood has been estimated at slightly more than 13,000 cubic feet per second (cfs) and the recurrence interval as somewhat more than 100 years.

2.4 Flood Protection Measures

There are no permanent flood protection structures in the City of Princeton and none are proposed at this time.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or

exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Two gaging stations where data are available were used to obtain discharge-frequency relations for the Rum River at Princeton. The gage on Hillman Creek near Pierz (No. 05267900, with 12 years of record) and the gage on the Snake River near Pine City (No. 05338500, with 22 years of record) were used in a log-Pearson Type III Analysis to determine the peak discharges for the selected recurrence intervals (Reference 4). The crest-stage site at Hillman Creek near Pierz to the northwest and the Snake River near Pine City to the northeast are both streams draining areas of terrain similar to the Rum River below Mille Lacs Lake. The peak discharges determined for Hillman Creek were coordinated with values determined by the Minnesota COE which were also determined with a log-Pearson Type III method of analysis. The values for the Snake River computed by the USGS were not altered. Since these values are real data from similar drainage basins adjacent to the Rum River, it was judged that the resultant lines would give reasonable estimates of flood peaks occurring on the Rum River and the West Branch Rum River from the intervening area below Mille Lacs Lake to the City of Princeton. Peak flood estimates were read directly from these curves and outflow from Mille Lacs Lake added to the main stem flows to obtain the discharges for preselected recurrence intervals. Mille Lacs Lake outflows were determined from elevation-frequency relations developed for the lake and outflow measured during the floods of 1972.

The two streams drain adjacent areas on a north-south axis, and major storms travel west to east; therefore, the flood hydrographs will combine at Princeton with greater peaks than are indicated by the discharge-drainage area curves for a single stream. The average of the sum of the peak discharges from the two streams and the value obtained from the discharge-drainage area curve was used for Rum River peaks below the West Branch Rum River.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
RUM RIVER					
At southeast corporate limits	968	9,900	15,100	17,700	23,000
At State Highway 95 bridge	784	6,050	10,000	12,100	17,300
WEST BRANCH RUM RIVER					
At mouth	184	4,120	7,000	8,300	12,000

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Overbank cross section data for the Rum River and West Branch Rum River were obtained by photogrammetric compilation using aerial photographs taken in fall 1977 (Reference 5). These photographs reflect current development conditions. Underwater portions of the cross sections and all bridges and culverts were field surveyed. Cross sections were located on grades and at close intervals above and below bridges to determine the backwater effects of these structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness coefficients (Manning's "n") for the step-backwater computations were assigned on the basis of field inspection of the channel and flood plain areas. Adjustments to the "n" values for the selected frequency floods were then made on the basis of historic flood profiles. The range of "n" values that were used in the analyses are shown below.

	Manning's "n"	
	Channel	Overbanks
Rum River	0.030-0.072	0.042-0.173
West Branch Rum River	0.034-0.085	0.038-0.144

The starting water-surface elevation for the Rum River was chosen by trial methods of convergence beginning more than a mile downstream from the corporate limits. The starting water-surface elevation for each of the frequency flows on the West Branch Rum River correspond to the elevation on the Rum River for the same frequency flood. Water-surface elevations for the 10-, 50-, 100-, and 500-year floods were determined using the COE HEC-2 step-backwater computer program (Reference 6). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for the selected recurrence intervals (Exhibit 1).

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using photogrammetrically compiled topographic maps at a scale of 1:3600, with two-foot contour intervals for the Rum River (Reference 7).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. In Minnesota, however, flood plain encroachment is limited by Minnesota Regulations to that which would cause a 0.5-foot increase in flood heights above pre-floodway conditions at any point (Reference 8). Floodways having no more than a 0.5-foot surcharge were delineated for this study. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

However, the construction of a bridge for State Highway 95 just upstream of Fifth Avenue North on the West Branch Rum River causes the profile of the 100-year flood to increase by a maximum of 1.0 foot. Since no other community is affected by this increase, and the Princeton City Council agreed on June 28, 1979, to zone for the additional rise above 0.5 foot, the FIA and the DNR have approved the floodway. Floodways having no more than a 0.5-foot surcharge have been delineated for this study, except between Fifth Avenue North and U.S. Highway 169 Bypass on the West Branch Rum River.

An engineering floodway was determined and floodway water-surface elevations were verified through use of the COE HEC-2 step-backwater computer program encroachment option 1 (Reference 6).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.5 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
RUM RIVER							
A	630	2702[4]	17,153	1.0	961.0	961.0	0.0
B	1470	2440/ 230[3]	12,768	1.4	961.5	961.4	0.1
C	4390	2678/ 290[3]	14,069	1.3	963.0	962.8	0.2
D	6495	2363/ 500[3]	14,488	1.2	963.8	963.6	0.2
E	8525	2272/ 810[3]	14,870	1.2	964.3	964.1	0.2
F	10,180	2301/1310[3]	19,110	0.9	964.6	964.4	0.2
G	11,500	1317	10,686	1.7	964.8	964.6	0.2
H	12,270	238	3172	3.8	965.0	964.7	0.3
I	13,725	1465	12,245	1.0	965.7	965.5	0.2
J	14,675	1897/1290[3]	14,083	0.9	965.9	965.7	0.2
K	15,580	969/ 580[3]	6962	1.7	966.1	965.9	0.2
WEST BRANCH RUM RIVER							
A	375[2]	330	2756	3.0	964.8	964.7	0.1
B	605[2]	180	1717	4.8	965.1	965.1	0.0
C	1080[2]	366	3248	2.6	966.4	965.5	0.9
D	1740[2]	776	6409	1.3	966.7	965.7	1.0
E	3195[2]	1140	7451	1.1	967.0	966.0	1.0
F	5515[2]	1325	9674	0.9	967.2	966.3	0.9
G	6505[2]	1323	8389	1.0	967.3	966.5	0.8
H	7810[2]	1740	6245	1.3	967.6	966.9	0.7
I	8250[2]	1100	6097	1.4	967.8	967.2	0.6
J	10,830[2]	1099	7421	1.1	968.9	968.6	0.3
K	14,135[2]	1260	7095	1.2	971.0	970.9	0.1
L	15,490[2]	1258/ 720[3]	7448	1.1	971.4	971.2	0.2

[1]FEET ABOVE LIMIT OF DETAILED STUDY 12,150 FEET DOWNSTREAM OF STATE HIGHWAY 95
[2]FEET ABOVE MOUTH
[3]TOTAL WIDTH / WIDTH WITHIN CORPORATE LIMITS
[4]THIS WIDTH IS BEYOND CORPORATE LIMITS

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF PRINCETON, MN
(MILLE LACS AND SHERBURNE COS.)

FLOODWAY DATA

RUM RIVER - WEST BRANCH RUM RIVER

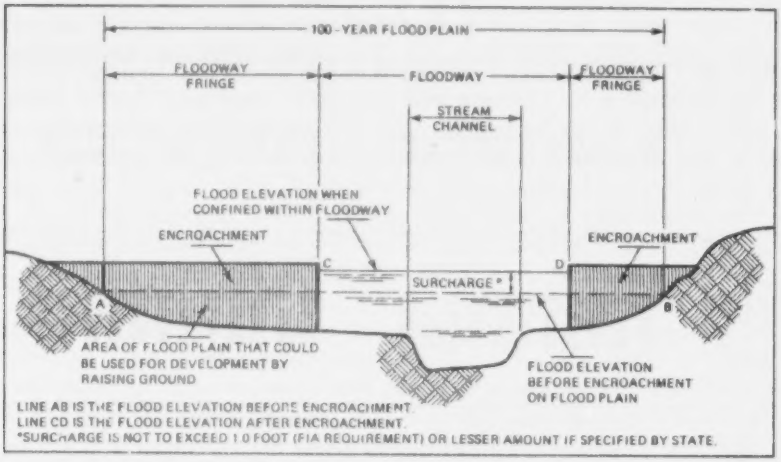

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the City of Princeton.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the City of Princeton are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Princeton was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A5:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
RUM RIVER							
REACH 1	0001	–2.4	–0.7	1.3	025	A5	VARIES–SEE MAP
WEST BRANCH RUM RIVER							
REACH 1	0001	–2.6	–0.8	1.8	025	A5	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
CITY OF PRINCETON, MN
(MILLE LACS AND SHERBURNE COS.)

FLOOD INSURANCE ZONE DATA

RUM RIVER - WEST BRANCH RUM RIVER

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Princeton is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

There are no published Flood Insurance Studies for Mille Lacs County. The County of Sherburne has a Flood Insurance Study in progress (Reference 9) and preliminary comparison showed these studies to be in total agreement. No other studies were found to exist for the Rum River and the West Branch Rum River flood plain at Princeton at this time.

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 10). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, One North Dearborn Street, Chicago, Illinois 60602.

8.0 REFERENCES AND BIBLIOGRAPHY

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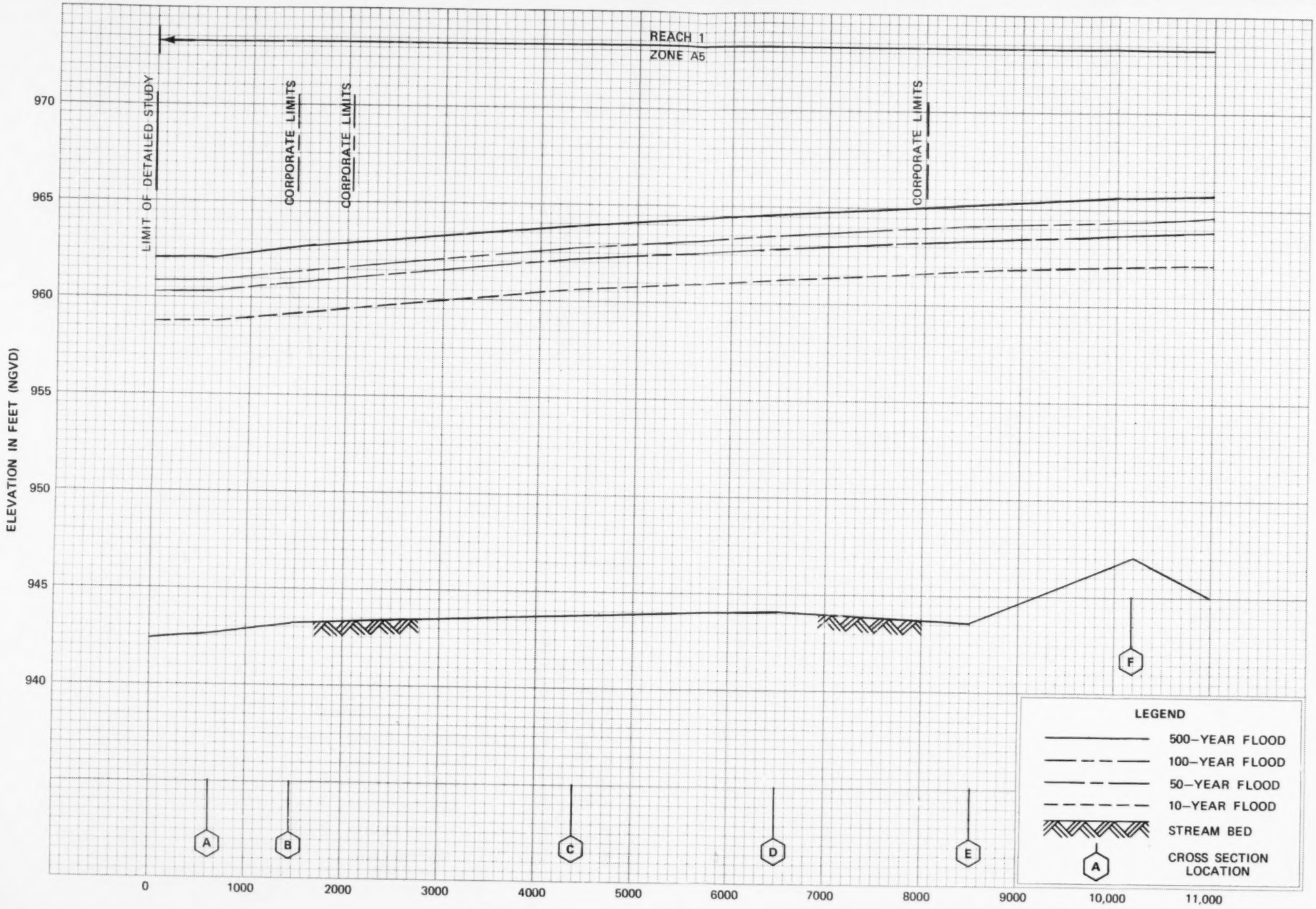
9. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Unincorporated Areas of Sherburne County, Minnesota, (in progress).

10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Princeton, Minnesota, February 1976.



STREAM DISTANCE IN FEET ABOVE LIMIT OF DETAILED STUDY
LIMIT OF DETAILED STUDY IS 12,150 FEET DOWNSTREAM FROM STATE HIGHWAY 95

FLOOD PROFILES

RUM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF PRINCETON, MN
(MILLE LACS AND SHERBURNE COS.)

01P

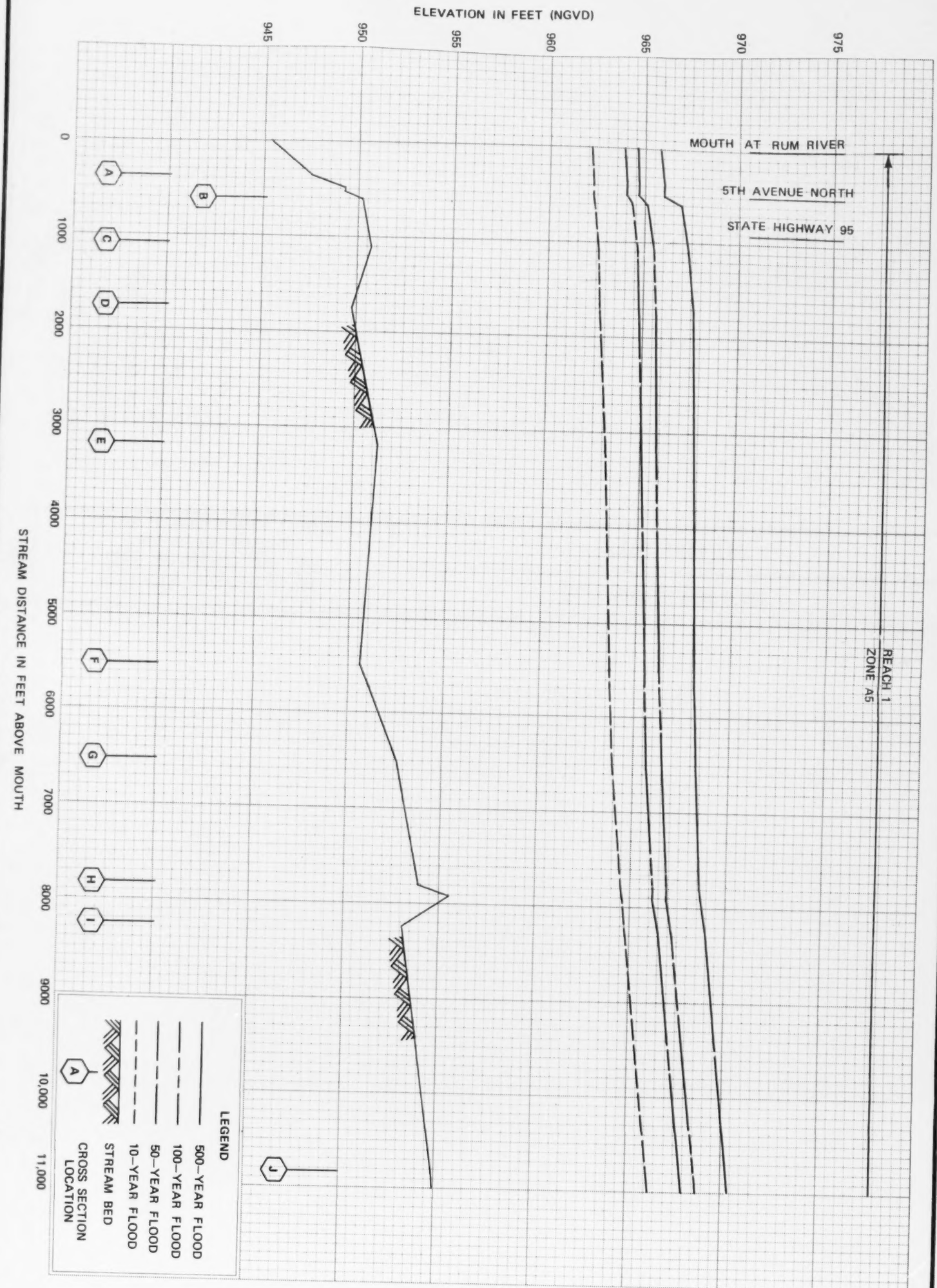
FLOOD PROFILES

RUM RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF PRINCETON, MN
(MILLE LACS AND SHERBURNE COS.)

02P



03P

FEDERAL EMERGENCY MANAGEMENT AGENCY
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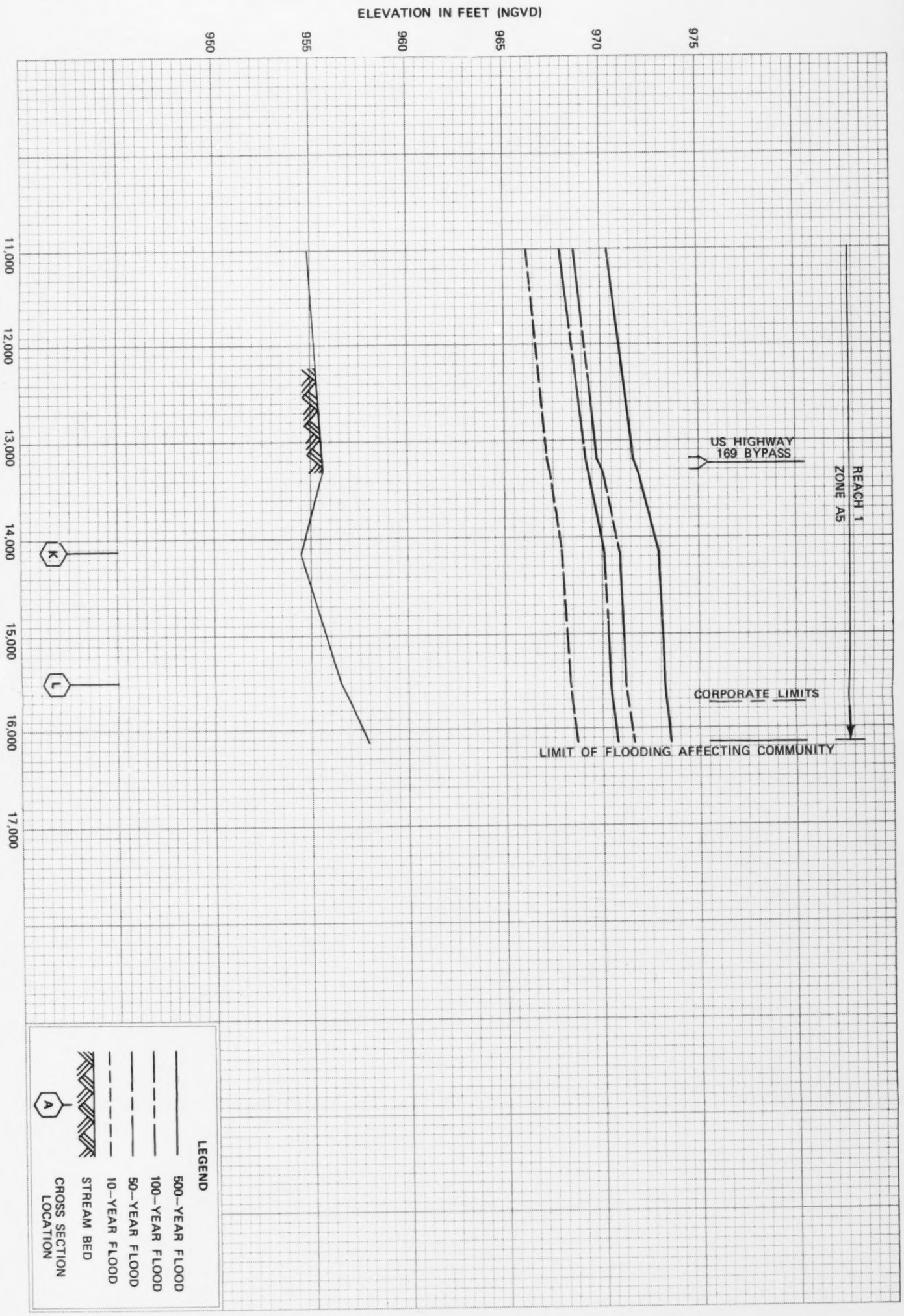
(MILLE LACS AND SHERBURNE COS.)

FLOOD PROFILES

WEST BRANCH RUM RIVER



04P

FEDERAL EMERGENCY MANAGEMENT AGENCY
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FLOOD PROFILES

WEST BRANCH RUM RIVER